

JSA 2008-2009 Graduate Fellowship

Final Report for Juliette M. Mammei

During my tenure as a JSA Graduate Research Fellow (2008-2009) I contributed to the analysis of the data taken during the backward angle phase of the G^0 experiment. G^0 is an experimental program which ran in Hall C at Jefferson Lab to determine the strange quark contribution to the charge and magnetization distributions of the proton, as well as the effective axial form factor, at two values of four-momentum transfer, $Q^2=0.22$ and $0.63 \text{ GeV}^2/c^2$. The complete separation requires measurements of the parity violating asymmetry (due to the interference of the scattering via a neutral Z boson with that of scattering via a photon) at forward and backward angles on the proton, and backward angles on deuterium for the particular Q^2 values of interest. The forward angle measurements spanned a range of Q^2 using a liquid hydrogen target. At backward angles two Q^2 values for each of a liquid hydrogen and deuterium target were made by varying the incident beam energy.

My primary tasks included analysis of the data quality, determination of the mean Q^2 for each of the four target/energy combinations, determination of the uncertainty due to the transverse component of the beam for each of these datasets, and analysis of the transverse data to determine the beam normal single spin asymmetries (BNSSA). The measurement of the BNSSA is an auxiliary measurement in the G^0 program of the parity conserving asymmetry caused by the interference of the imaginary part of two photon exchange with single photon exchange. Knowledge of this asymmetry will provide benchmarks for models which calculate the two photon exchange corrections which seem to explain the discrepancy between the determination of the ratio of the electric and magnetic form factor of the proton as determined using Rosenbluth separation and polarization transfer techniques. It also helps test the theoretical framework which calculates electroweak radiative corrections for precision electroweak experiments such as Q_{weak} .

I presented my work on the transverse asymmetries at the conference From Parity Violation to Hadronic Structure and more¹ (PAVI09) in Bar Harbor and the American Physical Society Division of Nuclear Physics² (APS DNP) meeting in Hawaii. The G^0 results have been accepted for publication in Physics Review Letters³.

¹ J. Mammei. Transverse Asymmetries, G^0 Backward Angle. Presentation at the June PAVI meeting. 2009.

<http://web.mit.edu/pavi09/speakerlist.html>

² J. Mammei. Transverse Beam Spin Asymmetries at Backward Angles in G^0 . Presentation at the October APS DNP meeting. 2009.

<http://meetings.aps.org/Meeting/HAW09/>

³ G^0 Collaboration. Strange Quark Contributions to Parity-Violating Asymmetries in the Backward Angle G^0 Electron Scattering Experiment. <http://arxiv.org/abs/0909.5107>